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ABSTRACT

This study assessed the qualifications of biology, chemistry, and physics teachers, both from the perspective of their initial preparation and with regard to the type of certification they possessed. In particular, the Ohio Department of Education sought to determine what patterns of preparation must be followed at each of Ohio's teacher education institutions before a recommendation is made for biological science, chemistry, or physics certification and what relevant certificate type is held by each teacher who teaches these subjects. Data examined included program formats from all Ohio teacher education institutions, teacher assignments, and types of certificates held. Results indicate that: (1) all of Ohio's teacher education institutions certifying biology, chemistry, and physics teachers have established a level of preparation commensurate with Ohio minimum standard requirements; (2) the vast majority of these institutions require substantial course work beyond the minimums; (3) most Ohio teachers responsible for these subjects possess the appropriate valid certificates; (4) only 4 percent of biology and chemistry and 5 percent of physics teachers do not possess appropriate certification; (5) the most common out-of-field certification is general science; and (6) science teachers are receiving substantial exposure to essential science concepts in their teaching field during teacher education programs. (JN)

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Biology, Chemistry and Physics Teaching in Ohio:

An Analysis of the 1982-1983 School Year

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The renewed emphasis on science in the school curriculum has generated vigorous debate regarding to the quality of instruction. The public is demanding that science teachers have the requisite knowledge and skills for effective practice.

In an effort to better understand the status of science teaching in Ohio, the Ohio Department of Education conducted a study focusing on the areas of biology, chemistry and physics. The study assessed the qualifications of science teachers, both from the perspective of their initial preparation and with regard to the type of certificate they possessed, if they had responsibility for teaching a biology, chemistry or physics course. In particular, the Ohio Department of Education sought to determine the following:

(1) What patterns of preparation must be followed at each of Ohio's teacher education institutions before a recommendation is made for biological science, chemistry or physics certification?

(2) What relevant certificate type is held by each teacher who teaches a biology, chemistry or physics course in Ohio?

Methodology

Data were collected from several different sources for the purposes of this study. First, all program formats for Ohio teacher education institutions were reviewed and analyzed. The formats outline the specific courses required by an institution before the dean or head of teacher education recommends certification. Audits of the formats by the Division of Teacher Education and Certification during the on-site evaluation process confirm the relative accuracy of the reported data.

Second, the Division of Computer Services, Ohio Department of Education, conducted an audit of all biology, chemistry and physics classes currently being taught(1982-83 academic year) in the state to determine the specific certification qualifications of the teachers responsible for instruction. The SF-1, OCCD-4 and OCCD-6 reporting forms were scanned to determine assignment data for biology, chemistry and physics.* The assignment data were then matched with the certification types.

Data Analysis

The method of data analysis regarding patterns of preparation included determining the number of hours required in each area of science certification as indicated on the program format sheets. Forty-five (45) of Ohio's forty-eight (48) teacher education institutions offer biological science certification, forty-four (44) offer chemistry certification and thirty-seven (37) provide course work for physics certification. The number of hours required for each of these areas of certification varies significantly from institution to institution. All institutions, however, meet the minimum requirements specified by the State (See Table 1), which includes twenty (20) semester or thirty (30) quarter hours in the area of specialization.

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*The SF-1 provides district certificated personnel information; the OCCD-4 provides subject assignment data; and, the OCCD-6 contains data on the number of full and part-time school staff in full-time equivalent positions.

Teacher Preparation in
Biology, Chemistry and Physics

Certification Field	State Requirement	No. of Institutions Preparing Teachers	% Institutions at or above Requirement
Biological Science	20/30*	45	100
Chemistry	20/30	44	100
Physics	20/30	37	100

*20 semester/30 quarter hours

Appendix A provides a summary of the number of hours of course work taken for certification in biological science, chemistry and physics for each institution approved to prepare teachers, and a general breakdown of the content area requirements for each of these science fields.

The second phase of the study entailed matching assignment data for biology, chemistry and physics with a teacher's area of certification (i.e., does a teacher in a high school chemistry class hold a valid certificate for that assignment?). A review of the SF-1, OCCD-4 and OCCD-6 forms revealed that 1728 teachers had assignments for biological science in Ohio high schools, 868 had chemistry assignments and 588 were teaching physics. For each category or area of specialization, the valid certification types were identified. Those pairings are listed below:

Teaching Assignment	Valid Certificates for Teaching Assignment
Biology	Comprehensive Science Biological Science
Chemistry	Comprehensive Science Chemistry Physical Science
Physics	Comprehensive Science Physics Physical Science

BIOLOGY - The data indicated that sixteen (16) percent of the teachers responsible for instruction in biological science hold comprehensive science certificates; seventy-three (73) percent hold biological science certificates; and four (4) percent do not hold either comprehensive science or biological science certificates and are, therefore, teaching out of field. (The remaining seven percent of the teachers hold permanent certificates issued prior to 1971. Data are not available for them in the current computer file.) Table 2 provides a summary of the data, including the total number of biology students taught by teachers with each form of certification.

Table 2

Biology Teachers

N = 1,728

Type of Certificate	% of Teachers with Cert.	Total Student Enrollment	Average Enrollment Per Cert. Teacher
Comp. Science	16%	20,317	73
Biology	73%	97,138	76
Out-of-field	4%	4,625	56

CHEMISTRY - Thirty-three (33) percent of the teachers responsible for the instruction in chemistry hold valid comprehensive science certificates; fifty-five (55) percent hold chemistry or physical science certificates; and four (4) percent are teaching out of field. (The remaining eight percent of the teachers hold permanent certificates issued prior to 1971. Data are not available for them in the current computer file.) Table 3 provides a summary of the data, including the total number of students taught by teachers with each form of certification.

Table 3

Chemistry Teachers

N = 868

Type of Certificate	% of Teachers with Cert.	Total Student Enrollment	Average Enrollment Per Cert. Teachers
Comp. Science	33%	16,115	56
Chemistry or Physical Science	55%	29,398	60
Out-of-field	4%	1,627	42

PHYSICS - In physics thirty-five (35) percent of the teachers responsible for instruction hold comprehensive science certificates; fifty-three (53) percent hold physics or physical science certification; and five (5) percent are teaching out of field. (The remaining seven percent of the teachers hold permanent certificates issued prior to 1971. Data are not available for them in the current computer file.) Table 4 provides a summary of the data, including the total number of physics students taught by teachers with each form of certification.

Table 4

Physics Teachers

N = 588

Type of Certificate	% of Teachers With Cert.	Total Student Enrollment	Average Enrollment Per Cert. Teachers
Comp. Science	35%	6,488	31
Physics or Physical Science	53%	11,166	35
Out-of-field	5%	606	19

DISCUSSION

The data gathered and analyzed for this study indicate that all of Ohio's teacher education institutions that certificate biology, chemistry, and physics teachers have established a level of preparation commensurate with Ohio minimum requirements and the vast majority of the teacher education institutions require substantial course work beyond the minimums.

Most teachers in Ohio classrooms responsible for biological science, chemistry or physics instruction do possess the appropriate valid certificate. Only 4% of the teachers in biology and chemistry and 5% of the physics teachers do not possess appropriate certification. Most of the out-of-field teachers do hold some form of science certification, but do not possess the specific valid certificate prescribed by the state of Ohio. The most common form of certification for the out-of-field biology, chemistry and physics teachers is general science. Almost one-half of the out-of-field biology teachers have general science certification; approximately one-third of the chemistry and physics teachers hold general science certification.

Data generated in this study suggest that science teachers in Ohio are receiving substantial exposure to the essential science concepts in their teaching field during teacher education programs. Generally, teachers with valid science certificates are being employed to teach in Ohio's biology, chemistry and physics classrooms.